

bart
impact
program

LAND USE AND URBAN DEVELOPMENT PROJECT RESEARCH PLAN

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The BART Impact Program is a comprehensive, policy-oriented study and evaluation of the impacts of the San Francisco Bay Area's new rapid transit system (BART).

The program is being conducted by the Metropolitan Transportation Commission, a nine-county regional agency established by state law in 1970.

The program is financed by the U.S. Department of Transportation, the U.S. Department of Housing and Urban Development, and the California Department of Transportation. Management of the Federally-funded portion of the program is vested in the U.S. Department of Transportation.

The BART Impact Program covers the entire range of potential rapid transit impacts, including impacts on traffic flow, travel behavior, land use and urban development, the environment, the regional economy, social institutions and life styles, and public policy. The incidence of these impacts on population groups, local areas, and economic sectors will be measured and analyzed. The benefits of BART, and their distribution, will be weighed against the negative impacts and costs of the system in an objective evaluation of the contribution that the rapid transit investment makes toward meeting the needs and objectives of this metropolitan area and all of its people.

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BART IMPACT PROGRAM

LAND USE AND URBAN DEVELOPMENT PROJECT RESEARCH PLAN



SEPTEMBER 1975
PLANNING DOCUMENT

PREPARED FOR
U.S. DEPARTMENT OF TRANSPORTATION
U. S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT



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FOR THE U.S. DEPARTMENT OF TRANSPORTATION
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TABLE OF CONTENTS

1. INTRODUCTION	1
1.1 The Research Plan	1
1.2 The BART Impact Program	1
1.3 Organization of the Research Plan	3
2. BRIEF DESCRIPTION OF THE PROJECT	4
2.1 Objectives	4
2.2 Scope	5
2.3 Scale and Time Frame.	8
2.4 Relation to Other BART Impact Program Projects.	9
3. THEORETICAL FRAMEWORK	10
3.1 Basic Concepts	10
3.2 The Impact Process.	10
3.3 Research Issues	13
4. RESEARCH STRATEGY.	21
4.1 Focused and Regionwide Studies.	21
4.2 Comparisons	21
4.3 The No-BART Alternative	22
4.4 Methods	23
4.5 Data	26
5. WORK ELEMENTS.	29
5.1 Preparation of Study Design and Project Implementation Plan	30
5.2 Accessibility Mapping.	31
5.3 Study of Households' Locational Decisions	32
5.4 Study of Workers' Locational Decisions	34
5.5 Study of Housing Industry	34
5.6 Study of Office Construction Industry	36
5.7 Study of Development Patterns	36
5.8 Study of Employers' Locational Decisions.	37
5.9 Study of Retail Sales and Consumer Services	38
5.10 Study of Patterns of Spatial Distribution of Population, Housing and Employment	39
5.11 Documentation of BART's Consumption of Land and Property	40
5.12 Documentation of BART's Construction Impacts	40
5.13 Study of Property Values and Rents	40
5.14 Study of Property Acquisition and Occupancy	42
5.15 Collection of Station Area Land Use Data	43
5.16 Policy Oriented Case Studies	43
5.17 Recommendations for Long Term Monitoring of BART Impacts	45
5.18 Preparation of Final Report	46
6. WORK PLAN	50
6.1 Schedule.	50
6.2 Project Office.	52
6.3 Staffing.	52
6.4 Level of Effort	52
GENERAL REFERENCES.	55

LIST OF FIGURES

	<u>Page</u>
1. BART Attributes and Intermediate Phenomena	6
2. The Impact Process	11
3. Hypothesized Impacts of BART on Land Use and Urban Development.	14
4. Coverage of Research Questions in Work Elements.	47
5. Schedule of Work Elements.	51
6. Approximate Level of Effort.	54

1. INTRODUCTION

1.1 The Research Plan

The purpose of the Land Use and Urban Development Research Plan is threefold, to define the technical scope of the project, to identify specific research issues and to outline methods for performing the work.

The efforts of Phase I of the Land Use and Urban Development Project were directed to defining the scope of work, identifying appropriate methods and available data, and producing a Research Plan. Phase II which will commence in the Fall of 1975, will carry out the work described in the Research Plan. This document, which contains MTC's description of the work to be done and specific recommendations on how to do it, is therefore the principal reference for Phase II.

The Research Plan does not however resolve all research issues. Some remain, but at least two opportunities exist for resolving these and further refining the work described in the Research Plan. The first will be prior to the award of a contract for performance of Phase II of the Land Use and Urban Development Project. At this time when potential contractors are developing proposals, explicit plans for conducting the research will be laid out. The plans contained in the proposals for conducting the research are expected to be elaborations of the Land Use and Urban Development Project Research Plan. Shortly after contract award a second opportunity will exist for refining the research effort. Within the first 60 days of contract performance, the successful contractor will prepare a Study Design and a Project Implementation Plan. These documents in addition to building on the Research Plan will reflect the comments and recommendations from MTC's review of the successful bidder's proposal. The Study Design and the Project Implementation Plan are described below in Section 5.1.

1.2 The BART Impact Program

The BART Impact Program is a comprehensive, policy-oriented study and evaluation of the impacts of the San Francisco Bay Area's new rapid transit system (BART). The program will identify and measure BART's impacts on the environment, travel behavior, the regional economy, land use patterns, public policy, and social institutions and life styles. The bulk of the work will be performed by contractors, with MTC providing program design, management, and synthesis and interpretation of the findings. The program is described in detail in A Description of the BART Impact Program, MTC, March 1974.

The objectives of the impact assessment program are to contribute to the making of better decisions on urban transportation

and development at all levels of government, and to add to knowledge of these subjects, by providing answers to four kinds of questions:

- o What are the impacts of BART on travel conditions, economic activity, land use, public policies, and other aspects of life in the metropolitan region?
- o Who is affected by these impacts? In what manner are the impacts distributed among income groups, communities, and economic interests; and in what way do they affect ethnic and racial minorities, the elderly, youth, women, the handicapped, and other groups of social concern?
- o Why do these impacts occur? Of equal interest, why do some anticipated impacts not occur, or occur in a lesser or different way than expected?
- o How can the fullest possible benefits be obtained from the Bay Area's investment in rapid transit, by complementary actions such as provision of feeder service, marketing transit service, and zoning for intensive development around the stations? Equally important, how can the lessons of the BART experience be transferred to other metropolitan areas where investments in transportation improvements are being considered, and to the state and Federal governments for guidance of their urban transportation and development policies?

The BART Impact Program has been divided into six areas for purposes of management and contracting. These impact areas are:

- o Transportation System and Travel Behavior
- o Environment
- o Land Use and Urban Development
- o Public Policy
- o Economics and Finance
- o Institutions and Life Styles

In each impact area, the bulk of the work is organized in a project to be performed by a contractor.

The Land Use and Urban Development Project covers BART's impacts on the location of population, activities, and urban development; on the character, form and functioning of spatial groupings such as business districts and residential neighborhoods; and on the market for real property which exercises a major influence on locational patterns.

1.3 Organization of the Research Plan

The following five major sections of this document describe the Land Use and Urban Development Project, its conceptual underpinnings, the strategy for carrying out the research, the specific Work Elements which comprise the total effort and the schedule for carrying out the work.

Section 2 summarizes the project, outlining for the reader the objectives of the project and the scope of work. This abbreviated description of the Land Use Project can be supplemented by reading the Project Description of the Land Use Project Request for Proposal.

The theoretical framework for the project is discussed in Section 3. The reader is first presented with some basic concepts and word definitions which are necessary to understand later discussions. The process by which impacts are expected to occur is then outlined with particular emphasis placed on tracing impacts through a causal network back to particular attributes of the BART System. The research questions which define the work to be done are then listed by the attribute of BART expected to cause that anticipated impact.

Section 4 outlines the role of the No-BART Alternative in determining impacts and discusses the methods proposed for carrying out the research. Following this is a discussion on data encompassing use of secondary sources, new data collection and data coordination

Section 5 specifies Work Elements. These are descriptions of 18 tasks which must be accomplished in order to fulfill the objectives of the project.

The final part, Section 6, is MTC's best estimate of schedule, staffing and level of effort.

2. BRIEF DESCRIPTION OF THE PROJECT

2.1 Objectives

The objectives of the project are to contribute to the making of better decisions on urban transportation and development at all levels of government, and to add to knowledge of these subjects, by providing answers to more specific forms of the four basic questions. These questions ask about the impacts of a regional rapid transit system on land use and urban development at two scales:

1. What changes does BART produce in land use and development in the BART station areas (such as concentration of high rise office development around downtown stations and apartment buildings near some suburban stations, increased retail sales activity in commercial areas around stations, etc.)?

Who is affected by these impacts (downtown office workers provided with more satisfying daytime environments, low-income people forced out of neighborhoods around stations by higher rents, etc.)?

Why do these changes occur (facilitating travel from suburbs to downtown retail districts, operation of supply and demand in the real property market, etc.)? Why are changes not as anticipated (restrictive zoning, withholding of land by speculators, etc.)?

How can BART's impacts be controlled and complemented in order to secure more beneficial land use patterns (public acquisition of land for intensive development, special incentives for private developers, etc.)?

2. What changes does BART produce in large-scale patterns of urban development and growth, and in the distribution of population (such as concentration of new development in BART corridors, increased employment in BART service area, etc.)?

Who is affected by these impacts (city residents and taxpayers affected by any stimulus that is given to "white flight", suburbanites affected by new growth pressures in built-up areas, etc.)?

Why do these changes occur (attraction from other parts of the Bay Area of employers seeking access to labor force, enhanced accessibility of outlying areas for residential development, etc.)? Why are

the effects not as anticipated (speculative rise in land values, presence of earthquake hazard or other geologically sensitive areas in BART impact area, etc.)?

How can BART's potential impacts be channeled to secure more beneficial patterns of growth and population distribution (development of new towns, open space preservation programs, etc)?

In seeking answers to these questions, special attention will be paid to ascertaining how BART has affected minority groups and other groups of special concern such as the poor and the elderly, and to identifying measures that can be taken to enhance BART's positive impacts and mitigate any negative impacts on such groups.

Policy relevance will be a prime concern in stating more specifically the questions to be answered, designing the research and presenting the results. Every effort will be made to produce findings that are of use to decision makers (public officials, technicians and citizens) in the Bay Area, in other urban areas, and in the state and Federal governments. Suggested audiences include 1) the nation and Congress concerned with priorities for transportation and urban development policies, 2) Federal Departments concerned with improving policies and programs, administrative guidelines and assistance affecting State, regional and local development of integrated transportation and land use patterns, 3) State, metropolitan and local governments concerned with making decisions on investments and planning, design and engineering, construction and operation of future transportation systems.

In order to assure that the findings are useful outside the Bay Area, special efforts will be made in the research design to guarantee transferability. To be transferable the findings must not simply describe what happened in the unique historical, social, and topographical circumstances of the Bay Area in the 1960's and 1970's. Findings must be presented in a form that provide an understanding of how specific characteristics or attributes of the rapid transit system affect specific populations and socio-economic processes.

2.2 Scope

The Land Use and Urban Development Project is a study of the impacts of BART attributes as they affect various land use activities. The scope of activities to be studied in the Land Use and Urban Development Project include: (1) decisions about the location of residences, activities and urban development within the Bay Area, (2) the behavior of the market for real property which exercises a major influence on such locations, and (3) the resultant spatial distributions of people, activities and development.

The many decisions required to build, design and finally construct BART produced a heavy rail rapid transit system with, among other things, particular operating, service and fiscal characteristics. For purposes of assessing BART's impacts, these characteristics are organized in general categories called system attributes. These attributes--discussed further in Section 3.2, The Impact Process--provide an organizing structure by which the scope of the project is defined and related to the project objectives.

BART attributes generally affect land use and urban development through some intermediate phenomenon. Figure 1 shows the principal BART attributes that may produce impacts and the immediately affected phenomena through which impacts occur.

Figure 1

BART Attributes and Intermediate Phenomena

Attributes	Intermediate Phenomena
The <u>transportation service</u> rendered	Travel conditions, (speed, comfort, safety, cost, etc.) as summarized by <u>impedance</u>
The presence of physical <u>facilities and operations</u>	The physical environment (noise, views, air quality, etc.), as summarized by <u>ambience</u>
The <u>taxes</u> that pay for the system	The financial conditions of households, firms, etc., as summarized by <u>income</u>
The system's <u>planning and publicity</u>	The attitudes of builders developers, businessmen, home buyers etc.
The utilization of <u>land resources</u> by transit facilities	None. This attribute directly affects land use because the BART facility itself occupies land.
The <u>construction process</u>	Travel conditions and the physical environment during the construction period

Transportation service provided by BART, for example, might improve travel conditions in such a way that certain areas become more attractive to line in. The intermediate phenomenon is, in

this case, improved travel conditions. As a result of reduced travel impedances, some people with center city jobs might decide to move to an outlying suburb and maintain approximately the same travel time to work; other people might move to within walking distance of BART to shorten their daily work trip. Decisions like these about residential location are thus mediated through the phenomenon of improved travel conditions provided by BART. Although some BART impacts may be the direct results of a system attribute (for example, BART displaced people and businesses by occupying lands which were formerly used for other purposes), most impacts are adjustments, via an intermediate phenomenon, to the system in operation. These impacts described in terms of the project scope include decisions of people and businesses, which, made in a real estate market, result in changed spatial distributions of people, activities and development.

2.2.1 Decisions

BART's impacts on the following kinds of decisions will be examined:

- o Decisions of households on the location of their dwelling places.
- o Decisions by workers on the locations at which they will work.
- o Decisions by various organizations on the location of their establishments and decisions by their clients on where to engage in transactions, for the following kinds of activities (selectively and with awareness that the categories overlap):
 1. Retail trade
 2. Other population-serving activities:
 - Bank, savings and loan
 - Medical
 - Educational
 - Entertainment
 - Hotel and restaurant
 - Etc.
 3. Business-serving activities:
 - Professional and technical functions,
 - sales and service activities, etc.
 4. Activities with large office functions
- o Decisions by the construction industry on the location of new construction and disposition of the existing stock (residential, office and commercial).

2.2.2 Real Property Market

BART's impacts on the market will be studied by examining:

- o Ownership patterns
- o Occupancy patterns
- o Property values
- o Rents

2.2.3 Spatial Distributions

- o BART's resulting impacts on spatial distributions is to be studied by examining population and employment over the entire affected area, and retail trade among selected retail centers.
- o The distribution of urban development by types and densities of development, and the distribution of various types of land uses, and the spatial patterning of conversion of vacant and agricultural land to developed land will be assessed.
- o The project will document the consumption of land and the resultant displacement of activities and removal of buildings by the BART facilities, and the disposition and usage of excess land acquired in building the rapid transit system.
- o The project will go beyond the measurement of locational changes to examine their consequences for the character and functioning of the spatial subdivisions of the urban area. This will include, for example, studies of BART's impacts on the social and ethnic composition of communities, the mix of activities in retail areas, and the interrelationships among activities in office districts.

2.3 Scale and Time Frame

Although some BART impacts might be experienced throughout the greater nine county Bay Area, they are expected to be relatively small outside the BART service area. The project should therefore concentrate research efforts in areas where the greatest impacts are anticipated. MTC recommends that in relation to the study of decisions (2.2.1) and the real property market (2.2.2), the focus of the project be upon an area not larger than the three BARTD counties (Alameda, Contra Costa and San Francisco) and parts of two other counties (San Mateo and Santa Clara) falling within the BART service area. Spatial distributions (2.2.3) can be examined at several scales, ranging from the regional

(examination of patterns covering the entire region or sizable portions of it, employing relatively large units of analysis such as the ABAG-MTC set of 440 zones) to station areas (examination of patterns in the immediate vicinity of stations, employing units as small as the individual building and establishment). An intermediate scale such as a corridor, a municipality, or a residential community should be used where appropriate. The project will cover the period from 1962, when the BART bonds were approved by the voters of the three counties, through 1976, when BART will have achieved full operation. Pre-1962 data may be used where appropriate to establish growth trends. In addition, the project will include preparatory work for the monitoring of impacts on land use and urban development into the post-1976 era.

2.4 Relation to other BART Impact Program Projects

The project will not cover impacts on the total regional magnitudes of population, jobs, and other variables of interest, but will be provided with data on these magnitudes, insofar as they are needed and can be obtained, by the Economics and Finance Project. The project will also not study BART's impacts on governmental actions (affecting land use and development (zoning renewal, etc.)). Information on BART's effects on local government will be provided, as needed, by the Public Policy Project.

3. THEORETICAL FRAMEWORK

A successful and efficient identification and measurement of BART's impacts requires a theoretical framework. The theoretical framework for this project is a set of basic concepts, a statement of the manner in which impacts are presumed to occur, and a set of research questions that are based upon the theory. This chapter sets forth the concepts, the theory of impact processes, and the research questions.

The material in this chapter draws upon a combination of the overall theoretical framework of the BART Impact Program, and the available literature on land use and urban development.

3.1 Basic Concepts

Persons interact in various ways. Much of their interaction occurs within organizations (households, firms, etc.). Organizations maintain establishments (a household at its dwelling place, a branch store of a retail firm, etc.). Establishments occupy structures that have locations in space. A transportation system links structures.

Each person's daily interaction is organized into a series of transactions (an evening with one's family, a day's work, a retail purchase, etc.). Most transactions are performed face-to-face, necessitating travel by persons between the establishments in which their transactions occur.

Persons and organizations make decisions about the kind and location of structures, transportation system, establishments, transactions, and travel. These decisions are made within several interaction systems that include markets and physical systems (humans and equipment in buildings, autos on highways, etc.). The interaction determines, and is in turn regulated by, price in markets and quality of performance of physical systems as affected by their loadings (building comfort, highway speeds, etc.).

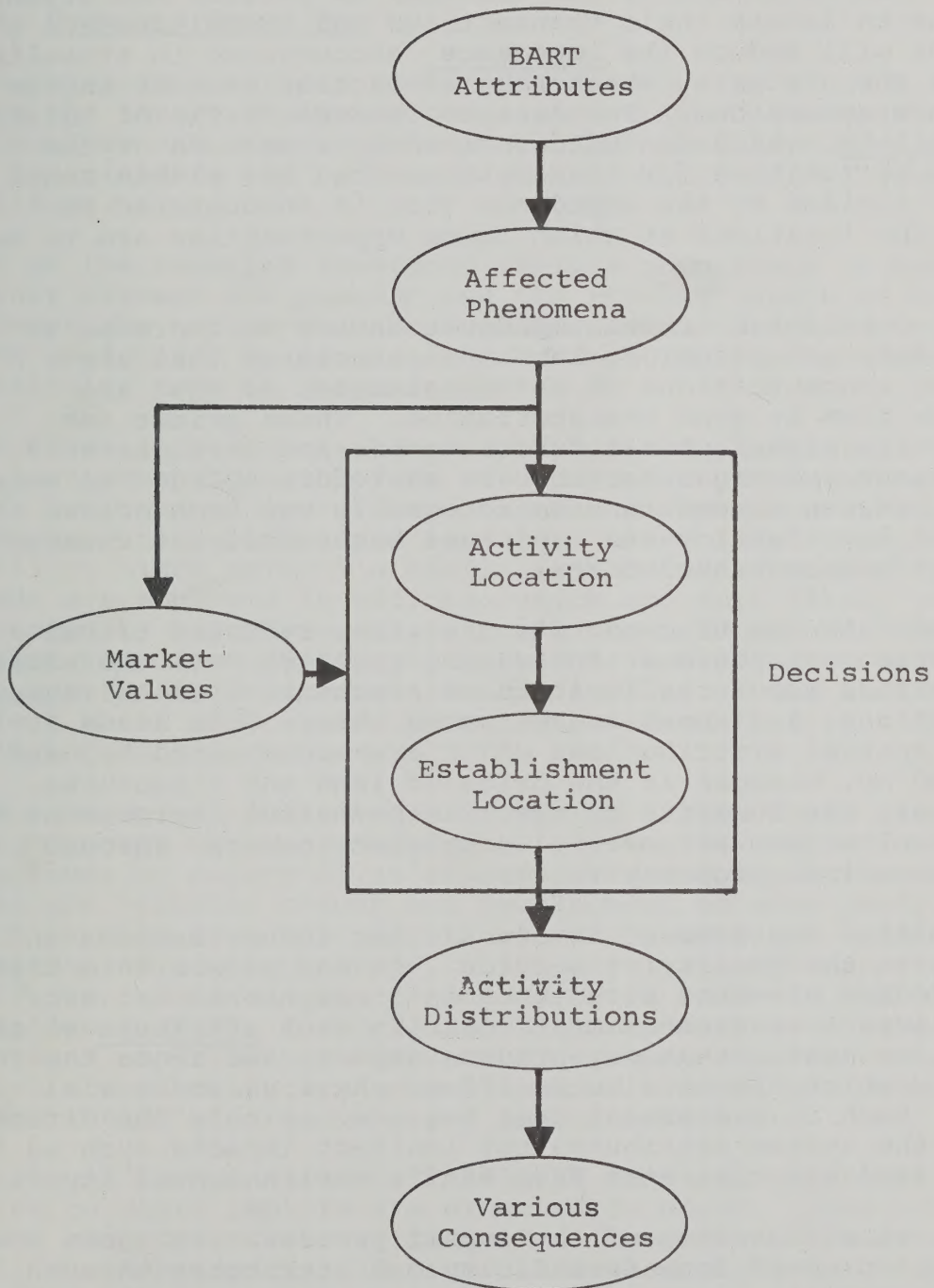
The interaction produces a distribution in space of structures, establishments, transactions, vehicles, and persons. This spatial distribution in turn affects future decisions, interactions, prices, and loadings. Figure 2 portrays how decisions and market activities are affected by specific BART attributes through intermediate phenomena to produce spatial impacts and other consequences.

3.2 The Impact Process

In this process of interaction, persons and organizations decide

Figure 2

THE IMPACT PROCESS



simultaneously upon the locations of more than one of the basic entities. A firm may decide upon the location of both an establishment and a structure, or of an establishment and a set of transactions; a person may decide upon both the location of a transaction and the location (route) of travel. In so doing, they interact simultaneously in the market and the physical system, considering simultaneously the prices and physical qualities.

In general, travel is costly and onerous, so persons and organizations prefer to locate their transactions and establishments at places which will reduce the impedance encountered in traveling to and from the places at which the interacting persons engage in their other transactions. The desired characteristic of locations is accessibility, which can be described by a measure of the number of opportunities for transactions that are within reach of a location divided by the impedance that is encountered in getting to the locations at which these opportunities are to be found.

The desire to minimize travel impedance causes an increase in the demand for, and price of, land and structures that are located near concentrations of establishments or that are connected to them by good transportation. These prices are associated with higher prices for the goods and services sold there. Persons and organizations are therefore obliged to make trade-offs between expenditure on accessible but high-priced locations at low travel costs and less accessible but cheaper locations at higher travel costs.

An improvement in the transportation system, reducing travel impedance (reducing price or increasing quality), may, therefore, affect decisions about the location of structures, establishments and transactions, and about travel among them. This leads in turn to changed spatial distributions which are accompanied by, and also limited by, changes in the price of land and structures. In particular, the benefits of the transportation improvement may to some extent accrue ultimately to property owners through capitalization into property values.

A transportation improvement involves other things besides an improvement in the quality of service. It may necessitate higher taxes, introduce elevated structures into neighborhoods, etc. A complete impact assessment must identify each attribute of the transportation system that may produce impacts and trace the processes by which the attributes affect physical and social phenomena. Such an assessment must measure not only the direct impacts of the system attributes but indirect impacts such as the effects on land use that stem from BART's environmental impacts.

Figure 3 is an elaboration of the impact process. It shows how impacts might proceed from specific system attributes through various intermediate phenomena to affect decisions on the location of transactions, establishments and structures. Likewise described are how these locational decisions are mediated through

the real estate market - a prime force in this process - to produce spatial distributions of people, activities and development, and indications of anticipated social consequences. The numbers in the chart refer to the research questions listed in the next section.

3.3 Research Questions

The research questions to be addressed by the project are drawn from the theory of impact processes outlined above, and from the objectives and expectations about BART that have been enunciated by its planners and by many Bay Area public officials and citizens.

All of the research questions imply a comparison of some kind--mainly between the present and the pre-BART state of affairs or between the actual and the No-BART world. The usage of terms such as "shift" or "increase" does not imply a commitment to a particular type of comparison.

The research questions can be refined and elaborated at length by casting them in the form of hypotheses or by approaching the work in terms of specific population groups, areas, etc. For example, the hypothesized impact on households' choice of dwelling place permits a distinction between households whose heads are employed in offices, which are most likely to be influenced by rapid transit, and all other households. The consideration of ethnicity would further refine the research. Again, the hypothesized increase in retail sales around stations is likely to be greater in the major business districts than in outlying retail centers.

A more complete statement of research issues would need to take into account the many modifying factors that may affect the magnitude or nature of an impact. These include the many forces that are bringing growth and development to some parts of the BART service area but not others the social and ethnic composition of a neighborhood, which may limit the opportunities for BART-induced development; zoning, which likewise may limit the response to BART; topography, which may make some sites near BART stations especially suitable for development; interest rates, which are exerting a strong effect on the overall pace of development in BART's first years of operations; etc.

It should be borne in mind that the research questions simply point to where impacts are expected to occur. They are only the first step toward the ultimate findings, which should not only tell whether impacts did occur but also measure the size of those impacts.

It should also be recognized that BART is likely to be a rather small influence on most of the phenomena in the list. In most

FIGURE 3

RESEARCH QUESTIONS

HYPOTHESIZED IMPACTS OF BART ON LAND USE AND URBAN DEVELOPMENT

THIS ATTRIBUTE	THROUGH ITS EFFECT ON THESE PHENOMENA,	INFLUENCES DECISIONS ON THE LOCATION OF THESE			AND AS MEDIATED THROUGH THE <u>REAL PROPERTY MARKET</u>	PRODUCES THESE <u>SPATIAL DISTRIBUTIONS</u>	WITH THESE <u>SOCIAL CONSEQUENCES</u>
		<u>TRANSACTIONS,</u>	<u>ESTABLISHMENTS,</u>	<u>AND STRUCTURES,</u>			
Transportation Service	Travel conditions, (speed, comfort, safety, cost, etc.), as summarized by <u>impedance</u>		1. Households	2. Housing - New Construction 3. Housing - Redevelopment	9. Increase in property values and rents near stations 10. Increase in total regional property values 11. Speculative acquisition of property near stations 12. Speculative withholding of property near stations	Population and residential development: 4. Shift to BART service area and station areas 5. Intensive residential development near stations 6. Extensive residential development beyond outlying stations	7,26. Replacement of low- income population and business by upper income popu- lation and offices in station areas 8. Movement out of cities by middle- income whites and middle-income minorities
		13. Working	14,15. All kinds of esta- blishments that employ people			16. Shift of employment to BART service area and station areas	
		17. Shopping for retail goods	18. Retail outlets			19. Shift of retail sales to BART station areas	
		20. Obtaining con- sumer services	21. Other population - serving establish- ments				
			22. Non-consumer serv- ing establishments				
			23. New office activity	23. Office Space- Redevelopment 24. Office Buildings - New		25. Intensive office development near stations	
Facilities and Operations	The physical environment (noise, views, air quality, etc.), as summarized by <u>ambience</u>		27. Households 28. Establishments seek- ing visual exposure	29. Housing	30. Decrease in property values along surface and elevated trackage		
Taxes	The financial conditions of households, firms, etc., as summarized by <u>income</u>				31. Decrease in property values in BART District		
Planning and Publicity	The attitudes of builders developers, businessmen, home buyers, etc.			32. Housing, office buildings			
Resource Utilization (Land)			33. Displacement of households and other establishments 34. Re-occupancy of air rights or surplus land	33. Demolition of pre- existing structures 34. Construction on air rights or surplus land			
Construction Process	Travel conditions and the physical environment during the construction period	35. Shopping for re- tail goods and obtaining services		36. Elimination or deferral of maintenance and con- struction	37. Temporary decrease in property values and rentals near construction		

NUMBERS ON THIS CHART REFER TO RESEARCH QUESTIONS IN SECTION 3.3

cases, other factors (such as a household's desire to locate in a community having good schools, or a firm's desire for a "prestige" location) may be far more influential than the presence of BART. This fact places a premium on carefully refined research issues and sharp methods of analysis.

The principal expected impacts, expressed as research questions, are as follows.

IMPACTS RESULTING FROM BART'S TRANSPORTATION SERVICE

Population and Housing. Of prime importance is BART's impact on the location of people and housing--of households and the structures that they occupy. The service provided by the BART system is presumed to affect the location of the residential population, which in turn exerts a strong influence on the locations of many establishments and structures.

1. Do households tend to locate their dwellings at sites for which BART provides improved accessibility in relation to
 - a. The places at which their members work?
 - b. Other establishments at which their members engage in transactions?
2. Do house and apartment builders tend to locate new construction in areas for which BART provides improved accessibility to workplaces and other transaction sites?
3. Does residential redevelopment (public or private) and rehabilitation of station areas occur in older urban areas?
4. Does population and residential development shift
 - a. To the BART service area from other parts of the region?
 - b. To BART station areas from outlying parts of the service area?
5. Does intensive residential development occur near stations that are not in major central business districts ("Manhattanization" in major cities, "nucleated development" in outlying areas)?
6. Does extensive residential development occur beyond outlying stations ("urban sprawl")?
7. Do upper-income people move into redeveloped station areas displacing lower-income people?

8. Is BART a stimulus to outward movement from the older urban areas for
 - a. Middle-income members of the majority population, especially families with children ("white flight")?
 - b. Middle-income minority group members?

Real Property Market. The above impacts on people and housing and those listed below on job location, employment, and services are all mediated through the market for real property. The workings of the market directly on real property or indirectly through other BART impacts can be better understood by answering the following research questions.

9. Do property values and rents increase in areas where accessibility is increased by BART?
 - a. Areas within walking distance of stations in business districts?
 - b. Areas within auto or bus access to stations outside business districts?
10. Do total regional property values increase due to
 - a. Enhanced productivity?
 - b. Concentration of accessibility, creating a steeper accessibility gradient (reducing the supply of land having the highest relative accessibility)?
11. Does speculative acquisition of land and buildings occur in station areas, accompanied by under-maintenance and shift to interim uses such as parking lots?
12. Does speculative withholding of land from the market occur in the BART station areas preventing assembly of large developable parcels and forcing development to occur in a spread out, fragmented fashion?

Employment. Also very important is BART's impact on the location of jobs. In 1974 a survey of BART riders showed that approximately 75 per cent of BART trips began or ended at work. This proportion is expected to decline only a moderate amount as night and weekend service is introduced. These impacts are closely related to those on residential location, since a person's job and dwelling place are often chosen jointly.

13. Do people tend to locate their workplaces at sites for which BART provides improved accessibility to their dwellings?
14. Do firms, governments, institutions, etc., tend to locate their establishments at sites for which BART 's

transportation service provides improved accessibility to

- a. The labor force?
 - b. Clienteles (retail customers, patients, etc.)?
 - c. Other organizations with which they interact?
15. Do firms, governments, institutions, etc., tend to locate their establishments at sites where accessibility is enhanced by BART-induced relocation of households and other organizations?
16. Do shifts of employment occur
- a. To the BART service area from other parts of the region?
 - b. To BART station areas from outlying parts of the service area?

Retail Trade. Another kind of impact, very important in the minds of BART's early planners, is on the location of retail trade. BART was intended to sustain the downtown business districts by enabling shoppers, as well as workers, to reach them.

17. Do people tend to do their shopping at places for which BART provides improved accessibility in relation to
- a. Their dwellings?
 - b. Their workplaces?
 - c. Places near the routes they follow in traveling on BART?
18. Do retailers tend to locate their outlets in areas for which BART provides improved accessibility in relation to
- a. Dwellings of clientele?
 - b. Workplaces of clientele?
 - c. Pedestrian routes followed by BART riders?
19. Does a shift of retail sales occur in relation to
- a. Commercial areas within walking distance of BART stations ("shopping goods")?
 - b. Sites along the pedestrian routes leading to the stations ("convenience goods")?

Other Population Serving Activities. The same kinds of impact may be expected to occur, in widely varying degrees, among the many other kinds of activities (services) that serve primarily the population at large. The following list identifies the main kinds of population-serving activities for which the subsequent questions should be considered.

- a. Bank, savings and loan
 - b. Medical
 - c. Educational
 - d. Entertainment
 - e. Hotel and restaurant
20. Do people tend to patronize establishments for which BART provides improved accessibility to their
- a. Dwellings?
 - b. Workplaces?
 - c. Establishments near the routes they follow in traveling on BART?
21. Do firms, institutions, etc., tend to locate their establishments in areas for which BART provides improved accessibility to the
- a. Dwellings of clientele?
 - b. Workplaces of clientele?
 - c. Pedestrian routes followed by BART riders?

Non-Consumer Goods and Services. BART may either enhance or offset the tendency for firms that specialize in non-consumer goods and services (except for the actual production and handling of goods) to congregate in central business districts, as indicated by this two-sided question.

22. Do firms tend to locate their establishments in areas for which BART provides improved accessibility to the organizations with which they do business?
- a. Away from central business districts (taking advantage of lower site costs and relying on BART for access to CBD)?
 - b. In central business districts (responding to increased business activity attracted to the CBD by BART)?

Office Activities. Cutting across the above categories are office activities, which owe their special importance to their concentration in central business districts and to their prominence in the minds of BART's planners--BART was above all intended to sustain the downtown employment concentrations by enabling office employees to get to their workplaces.

23. Do redevelopment (public or private) and rehabilitation of station areas occur in older urban areas, bringing in new office activities?
24. Do office building developers tend to locate new construction in areas for which BART provides improved accessibility to the dwellings of office employees?
25. Does Intensive office development tend to occur near BART stations ("Manhattanization" in downtown, "nucleated development" in outlying areas)?
26. Do businesses serving upper-income people move into redeveloped areas and displace lower-income people and the businesses that serve them?

IMPACTS RESULTING FROM BART'S FACILITIES AND OPERATIONS.

These impacts, stemming from the operations of the BART facilities, concern the location of establishments (households and businesses) the location of structures, and the adjustments of the real property market to negative impacts.

27. Do households tend to locate their dwellings away from sites at which BART produces noise, visual, and other adverse environmental impacts?
28. Do firms tend to locate their establishments at sites for which BART surface and elevated trackage provides exposure to the traveling public?
29. Do house and apartment builders tend to locate new construction away from areas in which BART produces noise, visual, and other adverse environmental impacts?
30. Do decreases in property values and rents occur in areas in which BART produces noise, visual, and other adverse environmental impacts?

IMPACTS RESULTING FROM BART TAXES

Although few land use impacts resulting from BART taxes are foreseen, some adjustments in property values may occur in areas bearing the tax burden, but not benefiting from BART service.

31. Do decreases in property values occur due to capitalization of the BART property tax, at least in those parts of the

BART taxing district that are parts of a real property market extending outside the district?

IMPACTS RESULTING FROM BART PLANNING AND PUBLICITY.

These impacts are those stemming from the announcement of the BART system and the resulting expectations of business opportunities.

32. Do house, apartment and office builders tend to locate new construction near BART in response to attitudes and expectations generated by BART planning and publicity?

IMPACTS RESULTING FROM BART'S UTILIZATION OF RESOURCES (LAND).

These are impacts that can readily be identified and measured without an elaborate hypothesis-testing methodology.

33. What effects did the BART facility have on the use of land, demolition of structures, and displacement of households, firms, and other organizations?
34. Has the construction of new buildings and the resulting occupancy by households, firms, and other organizations, occurred on land owned or sold by BART after construction of the BART facilities?

IMPACTS RESULTING FROM THE BART CONSTRUCTION PROCESS.

These impacts, stemming mainly from disruption of local transportation service and adverse environmental conditions, will be examined to a very limited extent, since they are now past and little reliable data is available.

35. Do property owners and builders tend to eliminate or defer maintenance, rehabilitation, and new construction in areas near BART underground construction?
36. Did people shop and procure services at places away from BART during underground construction?
37. Did temporary decrease in property values and rents occur in areas near BART underground construction?

4. RESEARCH STRATEGY

This chapter sets forth the overall research strategy of the Land Use and Urban Development Project. It outlines in general terms the research to be undertaken in studying the locational decisions of people and organizations, the real estate market in which these decisions take place, and the resultant spatial distributions of transactions, establishments and structures.

4.1 Focused and Regionwide Studies

In order to secure a full understanding of BART's land use impacts, the processes by which they occur and their consequences, the project will measure impacts in three general ways. First, the impacts of BART on locational decisions will be examined by studying specific decisions on the location of structures, establishments and transactions. This research will employ various kinds of interview surveys to ascertain how specific BART attributes affect decisions on the locations of households, retail purchases, office buildings, etc.

Second, the resulting impacts on the distributions of structures, establishments, and transactions, and on the real property market, will be examined by analysis of various kinds of secondary data representing these distributions and the interactions that determine them (census, assessors' data, etc.). Interviews of well informed observers will also be appropriate. Both of the foregoing kinds of research will be conducted in a highly focused manner, usually employing small population samples, limited study areas, etc.

As a third step, the impacts of BART on the distributions of the residential population and employment over the entire region, and perhaps within large sub-areas, will be examined by means of a regional simulation model. Ideally, the results of the first two kinds of research would be incorporated in the regional simulation model to sharpen its ability to describe the impact of changed accessibility on spatial distributions. If this does not prove to be possible, the existing capabilities of the simulation model will be employed to produce the best possible description of the impacts on the overall regional distributions.

4.2 Comparisons

The three kinds of research will be conducted largely in a comparative format. That is, the focused studies of impacts on decisions and distributions will employ a variety of comparisons, including comparison of the present state of affairs with pre-BART trends, comparison of areas near BART with areas farther away or outside its service area, comparisons of actual decisions with what the decision makers say they would have done in the absence of BART, etc. Such comparisons are appropriate means of identifying and measuring the impacts of specific BART attributes in specific situations. These specific impacts can only be understood by comparing them with the results that would have flowed from some other attribute that might have been incorporated in the design of the rapid transit system. The study of BART's impacts on regional dis-

tributions will likewise make use of a comparison, in this case between BART and an alternative transportation system together with the associated financing arrangements (the No-BART Alternative or NBA transportation system). This kind of comparison is needed for an assessment of the overall effects of the basic decision to build and pay for BART, which can only be assessed by comparison with the results of some other course of action that might have been taken. It is also needed to assure that BART's true net impacts are distinguished from the many other changes taking place in the region, which would have occurred in more or less the same way even if BART had not been built.

The regional simulation model will be used to make projections of spatial distributions resulting from each form of the No-BART Alternative. The differences between the projections and the actual state of affairs will be interpreted as the net impacts of deciding in favor of BART instead of the indicated alternative.

4.3 The No-BART Alternative

The comparison of BART with the NBA will be performed in two stages. The first stage compares BART with a transportation system which is much like today's system, less BART, but which also includes new, high-quality, high-speed express bus service in one or more corridors. The second stage adds a major investment in highway facilities (the Southern Crossing and associated freeways).

The main components of each stage of the NBA are described in A Generalized No-BART Alternative (GNBA) Transportation System, produced by a BART Impact Program contractor. This generalized description will next be converted to a more specific description. This NBA, in turn, will be given to each contractor for use in projecting the likely consequences of the NBA -- to TS & TB for projection of travel and traffic on the system; to Environment for projection of its noise, visual character, and other environmental effects; to Economics and Finance for projection of the local tax rates that would have prevailed if BART taxes were not strengthening taxpayer resistance; etc. The results of such projections will be fed from one project to another to permit the tracing of BART's indirect impacts. In particular TS & TB will provide the Land Use and Urban Development Project with mappings of the regional accessibility pattern, both with BART and with the NBA in place, and will produce projections of travel volumes on the No-BART system for comparison with volumes on the actual system in assessing changes in property values due to changed movement patterns.

Each project then will compare the actual state of affairs, as measured by it, with the state projected to result from the NBA, and will interpret the differences between the two states as the impacts of the choice of BART instead of the No-BART Alternative.

4.4 Methods of Analysis

A variety of analytical methods will be employed to carry out the research outlined in each Work Element. It is important to remember that no one optimal research strategy is recommended. The methods to be applied and data to be collected must be tailored to the individual research questions. While these may be loosely phrased hypotheses, hypothesis testing is not the only suitable analytical procedure. Also, while much quantitative data is available and will need to be employed in addressing many of the questions, qualitative descriptions and analyses will also be useful. The research strategy and analysis plan should take account of the relative importance of the subjects under study, the state of knowledge about the phenomena, the availability of proven techniques, and the costs of alternative approaches.

It is particularly important that the methods of analysis be adapted to the level and nature of the knowledge that exists about the subject at hand. This knowledge can be more or less precise. At one extreme, the theory concerning the subject may be very well developed and generalizable so that the impact process is understood, parameters are known, and data needs unambiguously specified. Statistical analyses repeatedly validate the model and values of parameters.

At the other extreme, neither the impact process nor the parameters of relationships are understood. Theory on the subject is not well developed, generalizations are not valid, and the subject population is ill-defined. Very little is known except that phenomena can be described in some empirical terms; but even then, the precision and validity of the description can be questioned.

Somewhere in between these extremes is a partial understanding of the impact process and the relationship parameters. In some cases, the structure of the impact process is strongly suspected, but parameter values are unknown. In other cases, theoretical constructs may be weak, but parameters are strongly suspected. Most methods to be applied in this project fall within this middle range.

The following statement on methods and the subsequent one on data should be viewed as recommendations for setting up research strategies for each Work Element. The methods recommended are for the most part generic and offer the contractor considerable latitude in formulating and proposing an optimal approach. Where MTC has been able to appraise a research issue in depth, more definitive recommendations on methods and data are made. These recommendations are minimum requirements and should be followed unless convincing arguments to the contrary can be presented.

Although analysis methods are discretely categorized in six areas, MTC is aware of the fact that some methods will probably overlap. The analytical methods to be used include inferential statistics, descriptive statistics, qualitative analysis, empirical case studies, policy-oriented case studies, and regional simulation modeling.

Although regional simulation modeling is also mentioned as an analysis method, its application will require further instructions from MTC.

4.4.1 Inferential Statistics

This term covers a variety of overlapping analytical approaches including hypothesis testing, causal modeling, regression analysis, etc. These are appropriate where there is a reasonably good understanding of the underlying processes and a fund of appropriate data. They offer the possibility of precise, quantitative findings, achieved in an economical manner where good theory and validated models permit generalization from small samples.

These techniques will be employed in studying BART's impacts on the distribution of retail sales and property values, and possibly impacts on decisions about the location of dwelling place and job.

4.4.2 Descriptive Statistics

This term applies to the use of quantitative data in situations where more rigorous inferential methods such as hypothesis testing or modeling are not possible, but where there is something to be learned with a reasonable degree of validity by careful analysis and interpretation. Much analysis of secondary data such as that provided by the census falls in this category. The available techniques cover a broad range from simple measurement and comparison of magnitudes to in-depth probing for relationships and application of various measures of association.

This approach often has a large cost advantage, especially where the main concern is not with precise understanding of causal processes but with measurement of an existing state of affairs or a trend for incorporation in a larger interpretive framework.

This type of analysis will be employed in most of the Work Elements, often to complement other methods.

4.4.2.1 Mapping and Map Interpretation

Also of descriptive nature are mapping and map interpretation used as analytical techniques. Since the project focuses on spatial phenomena, the presentation of data in map form and the interpretation of the spatial relationships thus made evident can be a useful technique. This will be employed in several of the Work Elements, both for purposes of analysis and as a means of displaying findings.

4.4.3 Qualitative Analysis

There is ample room for qualitative analysis in all of the Work Elements, especially where adequate quantitative data are not available, where the phenomena under study are not reducible to quantitative

terms (such as policies of leading home builders, constraints on development imposed by regulation, etc.), or where the findings need to be stated in terms that are relevant to specific policy decisions. Among the data sources that will require qualitative analysis are the key informant interviews and the photographic record of development in station areas.

4.4.4 Empirical Case Studies

Empirical case studies apply a variety of the above methods to a specific situation in order to probe more deeply into the phenomena under study, to obtain a more complete understanding than can be had from a single kind of data, to observe the interaction among different subject matters, and to synthesize the results in a way that reveals the full significance of what has been found.

Empirical case studies will be employed in assessing BART's impacts on unique locational decisions such as the siting of a large Federal office building or a junior college, on specific kinds of development such as office construction, on selected areas as a suburban community that is experiencing development pressures, on population groups such as low-income people residing in BART station areas that are subject to private renewal, and on other suitable subjects. Some such case studies, focused on specific areas, will provide the foundation of impact facts that are needed by the policy-relevant case studies to be undertaken as a separate Work Element.

The case studies will utilize a variety of data sources, including secondary data, key informant interviews, the results of surveys conducted by this project, photography, etc.

4.4.5 Policy-Oriented Case Studies

A few of the empirical case studies, focusing upon selected localities, will lay the foundation for policy-oriented case studies. These will carry the analysis forward to an examination of BART's implications for the policies of the affected units of local government. The policy-oriented case studies are described below as a separate Work Element in Section 5.16.

4.4.6 Regional Simulation Modeling

A large investment has been made in the development of regional land use and transportation models during the past two decades. While these have considerable utility for planners in appraising the manner in which various policies will affect development patterns and transportation system loadings, they have not yet achieved the soundness in theoretical basis or the precision in defining and measuring variables that is desirable for research application. Development of this kind of a model, or further work on the development of an existing model, is outside the scope of the BART Impact Program.

Some available models do appear to have the capabilities needed to assess BART's impacts on the distribution of people, housing, and employment within the Bay Area, at the large scale, with only a small investment in preparing the model for application to this purpose.

The extent to which resources are devoted to a regional simulation model will depend on an initial program of sensitivity testing which will ascertain how much significant information can be gained from use of the chosen model, given its present capabilities and the availability of data.

To the extent that sensitivity testing shows that the model can make a useful contribution to the understanding of BART's impacts, several simulation runs will be made with locational data from 1960-1965 and with transportation networks representing the pre-BART system, the 1976 system with BART in place, and a hypothetical "No-BART Alternative" system for the same year. The results of the simulations will be compared with each other and with the actual locational patterns in order to estimate the differences between the actual pattern and that which would have resulted if the Bay Area had decided to provide some other kind of transportation system.

The analysis will be repeated for one or two other No-BART Alternatives, each representing a different mix of transportation facilities and services.

4.5 Data

Data for assessment of BART's impacts on land use and urban development will be obtained from a variety of secondary sources, from other BART Impact Program projects, and from data collection activities by this project. The project's data collection activities will be designed to obtain data in a form that can be of use to the other projects by acquiring detail on socio-economic characteristics of the population and other key social variables.

4.5.1 Secondary Sources

The Survey of Data Sources for the Land Use and Urban Development Project published by the BART Impact Program provides detailed information on the nature and availability of a great many secondary sources. The description of each Work Element lists some sources which MTC feels may be especially useful in the performance of that work.

Plans for use of secondary data should take account of the fact that much of this data is stored in inconvenient places, and is only

available in a form that is far from ready for use in this kind of research. Allowance should be made for the time and effort that is needed for cleaning the data, merging files, identifying the data items that apply to a particular study site or period, drawing samples, transcribing to the desired form, etc.

4.5.2 Data From Other BART Impact Projects

The principal data inputs from other projects of the BART Impact Program will be:

- o From Transportation System and Travel Behavior -- measures of the manner in which BART affects the regional pattern of accessibility, comparable measures of accessibility with the No-BART Alternative transportation system in place, and data on travel behavior on the BART and (as projected) the No-BART systems.
- o From Economics and Finance -- data on regional magnitudes of employment and economic activity as affected by BART; findings on BART's influence on decisions about the location of establishments in the Bay Area or elsewhere; and information on the incidence of the BART property taxes and the taxes associated with the No-BART Alternative transportation system.
- o From Public Policy -- information on governmental policies and actions relating to land use and urban development, including zoning, urban renewal, public housing, land use planning, open space preservation, and growth policies.
- o From Environment -- information on environmental impacts of the BART and No-BART facilities and operations which may affect the use, development, and value of nearby property.

The BART Impact Program will also provide "pre-BART" data obtained by MTC and researchers under contract to MTC at the University of California, Berkeley, on several aspects of land use and development.

4.5.3 Original Data Collection

Original data to be collected include surveys of households, workers and key informants in the real estate and construction industries; data on rents, property sales, etc.

The kinds of original data to be obtained by the Land Use and Urban Development Project are described in general terms for each Work

Element. It should be noted that the several references to the use of surveys do not imply the conduct of that many separate surveys. Instead, consolidated surveys meeting the needs of this and other projects will be employed as far as possible. Separate surveys may still be conducted when needed to cover different populations, to obtain information in excess of what can be included in this project's share of a consolidated interview of reasonable length, or to meet other unique needs of the project.

4.5.4 Survey and Data Coordination

The purpose of the survey coordination plan is to facilitate the coordination of data gathering efforts within the Program by defining a procedure to monitor the development of all plans and activities associated with the collection of data. The plan proposed is intended to assist rational decision making in order to maximize the return to the program for the investment of resources in data gathering and analyses. The plan which is not intended just as a mechanism to eliminate redundancy, may support the decision to undertake separate data gathering efforts that appear to provide the same information when, in the larger context, it is more efficient to do so. Such decisions must be based on complete and current information and must be subject to constant review in the light of changing and emergent project needs.

The first step toward the development of a data monitoring procedure has already been taken by the creation of a "data catalog" within the MTC system. The Plans and Procedures for Coordination and Monitoring of Data is the second step in providing the information needed for managerial decision making. The plan includes recommendations for expanding the current data catalog to include "virtual" data sets (planned data gathering activities) insuring a single, central source for the review of past, current and planned data acquisition activities. The descriptions of "virtual" data sets will include dates, standard names for variables and variable groups, and descriptions of subject populations and units of analysis. Routine updating of the catalog will be made to permit a rapid and efficient search for data, variable, or population overlaps in planned and existing data activities.

5. WORK ELEMENT

This section describes the set of Work Elements into which the project will be divided. Most Work Elements involve the study of specifically identified anticipated impacts. Four Work Elements call for preparation of specific research documents and interpretive reports. Two are research procedures which need to be conducted in a unified manner to help design the research and assure efficient use of resources.

The Work Element descriptions contain key questions which are intended to focus the research on the principal kinds of impacts that MTC believes are likely to have occurred and to be worthy of study. These questions should be expanded and refined as needed in the early stages of the project. Special effort should be made to identify significant impacts not embraced by these questions.

All questions imply a comparison of some kind--mainly between the present and the pre-BART state of affairs or between the actual and the No-BART world. The usage of terms such as "shift" or "increase" does not imply a commitment to a particular type of comparison.

The questions can be refined and elaborated at length by casting them in terms of specific population groups, areas, etc. For example, the hypothesized impact on households' choice of dwelling place permits a distinction between households whose heads are employed in offices, which are most likely to be influenced by rapid transit, and all other households. Again, the hypothesized increase in retail sales around stations is likely to be greater in the major business districts than in the smaller retail centers.

It should be borne in mind that the questions, asking simply whether a certain impact occurred, are only the first step toward the ultimate findings, which should not only tell whether impacts occur but also measure the size of any impacts that do occur. A thorough presentation of findings should take into account and document the many modifying factors that may affect the magnitude or nature of an impact. These include, for example, the many forces that are bringing growth and development to some parts of the BART service area but not others; the social and ethnic composition of a neighborhood, which may limit the opportunities for BART-induced development; zoning, which likewise may limit the response to BART; topography, which may make some sites near BART stations especially suitable for development; and interest rates, which are exerting a strong effect on the overall pace of development in BART's first years of operations.

Some Work Elements are specific to the extent that precise study

areas are named. In the event not all the areas named in the individual Work Element can be studied, an option is sometimes provided. These options are minimum requirements. They name the specific areas which must be studied.

5.1 Preparation of Study Design and Project Implementation Plan

The purpose of this Work Element is the preparation of two project documents needed to carry forward the research planning already done to the point where data collection and analysis can proceed. The specific activities required are:

5.1.1 Review of Literature

The most important items in the relevant literature will be reviewed in order to assure that the Study Design has the benefit of the best available thinking on theory and methods.

5.1.2 Appriaisal of Data Sources

The availability and suitability of potential data sources will be closely examined (making full use of the information provided in the Survey of Data Sources for the Land Use and Urban Development Project) in order to provide a basis for decisions on specific research designs.

5.1.3 Preparation of Phase II Study Design

The Study Design for the Land Use and Urban Development Project will be an operational document describing the research to be undertaken by the project. Although the Study Design will be based on the statement of scope, methods, research issues and Work Elements contained in this Research Plan, the Study Design will describe in greater detail the research steps to be taken and reflect refinements made to the research design during the proposal and negotiation stage of contract procurement and the first few weeks of contract performance.

Although the Study Design need not follow the format of the Research Plan, it will contain the following:

- (1) An overview of the project that presents the conceptual framework for the phenomena that affect land use impacts, discusses processes that might be significantly impacted by transportation improvements, discusses measures of land use impact, and reviews the pertinent questions which the several audiences of the BART Impact Program will be most interested in. The theoretical statement will be integrated with that of the Transportation System and Travel Behavior Project, to assure a clear portrayal of the interaction of the transportation system, transportation user charges, travel decisions, land use and

development patterns, locational decisions, property taxes, and property values.

- (2) A presentation of the theoretical and methodological framework within which the study will be conducted.
- (3) For each Work Element a statement of the scope; a description of the factors, measures, relationships and testable hypotheses that will be the basis of the study; a selected methodology for doing the work--if in some case a firm choice is premature, a proposal for postponement of the decision must specify how, when and by what criteria the ultimate choice will be made; a description of data requirements and the associated measurement programs, including the geographical and classification parameters of the data sample and preliminary estimates of sample sizes where applicable; a description of pertinent data sources--if some sources cannot be specified now, then a description of how they will be located; a description of the analytical procedure and how it is expected to answer the important questions.

5.1.4 Project Implementation Plan

The Project Implementation Plan will describe in detail how the Study Design will be implemented. It will contain work flow charts, schedules, manpower allocations and budgets that provide a road map for project implementation. Early, interim and final products will be clearly identified and scheduled. Use of the Contractor's team and other resources will be described; milestones will be identified; plans for coordination with other Program activities and their project implementation plans will be delineated.

5.2 Accessibility Mapping

PURPOSE

To assess travel conditions (speed, comfort, safety, cost, etc.) as summarized by impedance in order to assist in the formulation of research activities in other Work Elements. This information will be especially useful for the sensitivity testing that must proceed selection of study areas and the use of a regional simulation model.

RESEARCH ACTIVITIES

Data on BART's impacts on the pattern of travel impedances (provided by the Transportation System and Travel Behavior Project) will be combined with data on the location of population and establishments (provided on a 440 - zone basis by the ABAG-MTC data system, as supplemented by other sources for

finer portrayal) to provide an assessment of BART's impacts on accessibility patterns. The findings will be presented in quantitative and map form.

5.3 Study of Households' Locational Decisions

PURPOSE

To study households' decisions to determine BART's impact upon the choice of residential location.

RESEARCH ACTIVITIES

1. The BITS Study Area

A home interview survey will be conducted in the four BITS* study areas, covering a sample of households which have purchased houses or rented apartments in the preceding two years. the survey will investigate the role of transportation, and BART in particular, in households' choice of where to live, the choice of a workplace by each employed member, and choice of places to obtain retail goods and consumer services.

Option - Cover only two or one BITS study areas.

Research Questions to be Answered: 1, 13, 17, 20.

2. Sunset, East Oakland Areas

A similar survey, limited to choice of where to live and work, will be conducted in a portion of the Sunset District of San Francisco and a portion of East Oakland, in each of which majority group population is declining and minority group population is increasing. The sample will cover households which have moved out of dwellings in this district within the past two years.

Option - Cover only the Sunset District.

Research Questions to be Answered: 1, 8, 13.

*The BART Impact Travel Survey (BITS), conducted in 1973-74, was the first measure of a two wave panel study designed to assess the impacts of the nearly opened BART system on travel related behavior and attitudes of San Francisco Bay Area residents. This household survey included a 45 to 60 minute personal interview with randomly selected adult members of approximately 400 households in each of four study areas. The survey also includes a one day trip diary filled out by adult members of each household.

The survey was conducted in four study areas, each tributary to

Each study will begin with the identification and sampling of recent movers by comparison of street address telephone directory listings, supplemented by use of alphabetical telephone directory listings, assessors' records, apartment building tenant lists, and other sources. Sample size will be approximately 200 in each study area.

In each study, a home interview will obtain detailed socioeconomic information on the household, basic facts about auto ownership and usual modes of travel, in-depth information on the decision whether to move, where to move, and where each employed member will work. Study 5.3(1) will also include detailed information on shopping for goods and services.

The data will be analyzed and interpreted by construction and specification of explanatory models employing statistical techniques appropriate to such a body of detailed behavioral data covering relatively small samples.

a single BART station and representative of selected types of Bay Area residents and travel conditions. By this approach, such local conditions as terrain, freeway accessibility, and the availability and quality of public transportation, could be determined for sampled households more readily than would be possible for a cross-section of the full BART service area.

Two study areas were chosen from the eastern side of San Francisco Bay (the East Bay) and two from the western side (the West Bay). In each region, one area was selected to represent a central city area with bus service and a sizable minority population and a second area was selected to represent the predominantly white, automobile-oriented suburbs with limited (or no) bus service.

In the East Bay, Oakland's Fruitvale District and adjacent hill areas were chosen to represent the central city, and an area in and near the City of Walnut Creek with an arm extending south through Danville toward San Ramon was chosen from the suburbs. These two areas are tributary to the Fruitvale and Walnut Creek BART stations, respectively.

In the West Bay, San Francisco's Mission District was chosen as the central city area, and an area beginning in the southwest corner of San Francisco and extending south through Daly City and Pacifica was selected for the suburbs. These two areas are tributary to the Mission-24th Street and Daly City BART stations, respectively.

5.4 Study of Workers' Locational Decisions

PURPOSE

To determine how decisions about job location are affected by BART.

RESEARCH ACTIVITIES

1. Downtown San Francisco and Oakland, and an Industrial Area in East Oakland or San Leandro

A questionnaire and interview survey of workers will be conducted in three employment centers: downtown San Francisco, downtown Oakland, and an industrial area in East Oakland or San Leandro. A sample of workers will be asked to provide key socioeconomic information on themselves and their households, basic facts about their travel to and from work, information on recent changes in their location of dwelling and work, and information on shopping and services obtained on trips beginning or ending at work. The questionnaire will obtain essential identifying information, while the interview will obtain details about how BART affects workers' locational decisions.

Option - Cover only downtown San Francisco.

Research Questions to be answered: 1, 13, 17, 20

A sample of employers will be drawn from a listing of employers in the area (omitting the smallest employers), and a sample of employees of each employer will be drawn. Sample size will be approximately 2,000 completed questionnaires and 200 completed interviews, in each area. The questionnaire survey will be used as a screen to select interviewees who are most likely to be affected by BART.

5.5 Study of the Housing Industry

PURPOSE

To determine BART's effects on the new and existing housing stock.

New housing will be studied by examining how decisions of home builders and apartment developers have been affected by BART. The existing housing stock will be studied by examining decisions on maintenance, rehabilitation and abandonment. The behavior of the housing market will also be studied.

RESEARCH ACTIVITIES

1. The BITS Study Areas

The behavior of the housing industry in each of the four BITS

areas (broadened to include the larger market areas of which these are parts) and in two other study areas during the preceding decade will be examined by means of interviews of key informants in the industry, financial institutions, government, etc.; and by collection and analysis of secondary data on construction, rehabilitation, maintenance, and abandonment of housing. The data will be analyzed to reveal trends and patterns in the housing industry in these areas, as affected by interest rates, family formation, and other national and local forces, including transportation improvements. The interviews will investigate the influence of transportation, and BART in particular, on behavior of the housing market and decisions about provision of housing within the context of the other forces at work. The interviews will also serve as a supplementary source of information on household decisions about dwelling location (5.3).

The areas Covered, in addition to the BITS areas, will be:
(a) hayward, and (b) fremont and union city.

The interviews will also investigate the effect of the above-ground BART facilities and operations on decisions about construction and occupancy of housing nearby.

Option - Cover only two or one BITS study area.

Research Questions to be Answered: 1,2,3,6,27,29,32

2. Pittsburg and Antioch

A similar study (omitting the role of the above-ground facilities) will be conducted in the Pittsburg-Antioch section of Contra Costa County.

Research Questions to be Answered: 1,2,3,32

3. Sunset and East Oakland

A similar study (omitting the role of the above-ground facilities) will be conducted in the areas covered by Work Element 5.3(2), to provide supplementary data.

Research Question to be Answered: 8

Each study will begin with preliminary analyses of secondary data; and will proceed with a survey of the housing industry in the area, identification of knowledgeable members and observers of the industry, and selection of a sample containing those in a position to know the most, from various perspectives, about market behavior and decision making. Sample size will be approximately 15 informants in each suburban area, 10 in each in-city area, and 5 to 10 in Pittsburg-Antioch. Further work on the secondary data will proceed in coordination with the interviews.

5.6 Study of the Office Construction Industry

PURPOSE

To study BART's effects on decisions about office construction and on the resulting distributions of office development.

RESEARCH ACTIVITIES

1. Three BART Counties (Alameda, Contra Costa, and San Francisco)

The behavior of the office construction industry in the three counties during the preceding decade will be examined by means of interviews of key informants in the industry, financial institutions, government, etc.; and by collection and analysis of secondary data on construction, rehabilitation and maintenance of office space. The data will be analysed to reveal trends and patterns in the office industry as affected by interest rates, employment growth, and other national and local forces including transportation improvements. The interviews will investigate the influence of transportation, and BART in particular, on behavior of the office market and decisions about provisions of office space within the context of the other forces at work.

Research Questions to be Answered: 23,24,25,26,32

The study will begin with preliminary analyses of secondary data; and will proceed with a survey of the office construction industry in the area, identification of knowledgeable members and observers of the industry, and selection of a sample containing those in a position to know the most, from various perspectives, about market behavior and decision making. Sample size will be approximately 20. Further work on the secondary data will proceed in coordination with the interviews.

5.7 Study of Development Patterns

PURPOSE

To examine the spatial patterns of development in areas around selected BART stations, and to ascertain what population groups and businesses have been displaced by BART-induced development.

RESEARCH ACTIVITIES

1. BART Station Areas

Secondary data, photographs, field survey, and key informant interviews will be used to identify, describe and interpret in greater detail, trends and patterns of development in areas

where BART may have had an influence as shown by Work Element 5.5 and 5.6. Two kinds of areas will be examined:

BART station areas (within a short trip by the feeder modes prevailing in the area).

Suburban: Walnut Creek, Pleasant Hill,
Concord, Union City, Fremont.

Outer Urban: Hayward, South Hayward.

Inner Urban: Fruitvale, Coliseum, 24th &
Mission, 16th & Mission.

Downtown: San Francisco, Oakland, Berkeley.

Research Questions to be Answered: 3,5

2. Outlying Areas

A similar study to that conducted above in 5.7(1) will be performed in areas farther from BART. These include Pittsburg, Antioch and Pacifica.

Research Questions to be Answered: 6

Urban areas where (according to findings from Work Elements 5.4 and 5.5) significant changes have occurred will be examined closely to ascertain what population groups and population-serving businesses have been displaced.

5.8 Study of Employers' Locational Decisions

PURPOSE

To examine BART's influence on locational decisions made by employers.

RESEARCH ACTIVITIES

1. Organizations Needing Access to Labor Force

Interviews of key informants (employers, firms dealing in commercial real estate, property managers, etc.) will be used to ascertain how BART affects locational decisions by organizations for whom access by the work force is an especially important consideration. The interview survey will not be confined to any one area or type of employer, but will selectively examine decision situations in which BART may have played a part. Special attention will be devoted to location of major increments of employment such as the Richmond office of the Social Security Administration. The interviews will seek to

distinguish between BART's tendency to encourage location at outlying sites for which impedance is reduced, and location in downtowns that are presumed to gain accessibility from BART's tendency to produce there further concentration of activities.

Research Questions to be Answered: 14,15

2. Firms Needing Access to other Organizations

A sample of firms having especially great dependence upon quick and easy communication with other organizations, of a kind traditionally located in downtown office districts, will be studied by means of interviews and collection of data on the business travel of their members. The data will be analyzed in order to ascertain to what extent BART either encourages their dispersal by reducing impedance, or their concentration by a presumed tendency to produce further concentration of activities.

Research Questions to be Answered: 22

3. Other Organizations

Similar key informant interviews will be conducted to ascertain whether any businesses have been attracted to sites near the BART above-ground lines in order to secure exposure to the traveling public.

Research Questions to be Answered: 28

5.9 Study of Retail Sales and Consumer Services

PURPOSE

To examine BART's influence on locational decisions made by organizations engaging in retail sales and other consumer-related activities. Decisions of the consumer on where to conduct transactions will also be studied.

RESEARCH ACTIVITIES

1. Shopping Patterns

The role of BART in choices of where to obtain retail goods and consumer services will be examined by means of three kinds of consumer surveys: home interviews (described in Work Element 5.3(1), workplace questionnaire and home interview (described in Work Element 4.5), and interviews of consumers conducted in retail and service establishments. The latter will be performed in a sample of establishments in each of the following business districts: downtown San Francisco, downtown Oakland, El Cerrito Plaza, Bay fair, and two or more highway-oriented shopping centers. Sample size will be approximately 200 completed interviews in each business district.

(Note: "Service", as used here, includes not only commercial services but health, education, etc.)

The data will be analyzed and interpreted by construction and specification of explanatory models that relate choice of shopping and service location to accessibility and other variables.

Research Questions to be Answered: 17,20

2. Establishment Location

Interviews of key informants (retailers, executives of service firms and institutions, firms dealing in commercial real estate, etc.), will be used to ascertain how BART affects locational decisions by retailers and service organization. The interview survey will not be confined to any one area or type of organization, but will selectively examine decisions in which BART may be devoted to location of major establishments such as Laney College.

3. Retail Sales

A time series of retail sales tax collection data for a sample of outlets in several business districts and shopping centers will be continued by collection of new data. The data available to date will be analyzed to detect any trends in distribution of retail sales that may be due to BART.

Research Questions to be Answered;

5.10 Study of Patterns of Spatial Distribution of Population, Housing and Employment

PURPOSE

To examine BART's impacts on population, housing and employment and the resulting spatial patterns at a regional or corridor scale primarily by means of a regional simulation model.

RESEARCH ACTIVITIES

In general the model will be specified on the basis of data from 1965 and 1970, and will be used to make several projections of population and employment to 1965 or 1976 or 1980. The projections will be based on the existing transportation system and on a hypothetical alternative system (the No-BART Alternative). Comparisons of the projections with each other, and with actual data for 1975 or 1967, will be employed to detect the manner in which BART has affected the distribution of jobs (by industry class) and people (by socio-economic and ethnic categories). The findings will also be interpreted to show how BART has

affected the geographical distribution of conversion of vacant and agricultural land to urban development and the distribution of development by densities and of land use by types.

Although this work will be undertaken as part of the Land Use and Urban Development Project, it will be performed under a contract separate from that which encompasses all the other Work Elements described in this document. MTC will specify the details of this work at a later time.

5.11 Documentation of BART's Consumption of Land and Property

PURPOSE

To determine the effects BART has had in terms of land consumed by the facilities themselves, and people and businesses displaced by the system.

RESEARCH ACTIVITIES

BART as a land use--replacing previously existing structures, occupying urban land, and returning some land to other use--will be documented by reference to the records of the property acquisition and disposal process. This will include documentation of the relocation of people and businesses.

Research Questions to be Answered: 33,34

5.12 Documentation of BART's Construction Impacts

PURPOSE

To determine BART's construction impacts on real estate, property values, and retail sales.

RESEARCH ACTIVITIES

The study of BART's construction impacts will be based on the summary and evaluation of readily available secondary data, and by inclusion of any information on this subject gathered in the interviews of key informants in the real estate industry and retailing.

Research Questions to be Answered: 35,36

5.13 Study of Property Values and Rents

PURPOSE

To examine BART's impacts on property values and rents and the redistribution of population that may result from these changes.

RESEARCH ACTIVITIES

1. Property Values

Data on values of real property will be collected and analyzed to ascertain the influence of BART on property values. Data sources may include assessor's records and sources in the real estate industry. The data will be employed to construct and specify an explanatory model of the influence of rapid transit on property values. The model will distinguish between increases in the values of properties in their present use and increases that anticipate change in use or new construction. The data and statistical analysis may be limited to a large sample of properties at a single time after the start of BART service or may cover a smaller sample with data for each at one or more times before and after the start of BART service.

The study will examine the impact both of BART's contribution to accessibility and of any adverse environmental effects of above-ground facilities and operations.

The study will cover the following areas and types of property.

- a. Suburban residential area - Walnut Creek, South Hayward, Pacifica.
- b. Outer urban residential area - El Cerrito, Fruitvale District.
- c. Inner urban residential and commercial area - Mission District.
- c. Suburban business district - Walnut Creek, Hayward.
- e. City business district - downtown San Francisco, downtown Oakland.

Option - Eliminate one area in each category except C.

2. Rents

Data on rents of residential and commercial properties, over a period extending from before the start of BART service to the present, will be obtained for structures in selected areas having a low proportion of owner occupancy.

The data will be obtained by surveys of owners and managers of a sample of buildings. They will be analyzed and interpreted, in conjunction with data on property values, to ascertain the effect of rapid transit on rentals.

The study will cover the following areas and types of property:

- a. Suburban residential area - Walnut Creek.
- b. Inner urban residential and commercial area-
Mission District.
- c. City business district - downtown San Francisco.

3. Key Informants

Interviews of key informants in the real estate industry (conducted as parts of other work elements) will obtain informed professional judgments as to the kind and amount of property value changes due to BART. These judgments will be summarized, evaluated, and interpreted to supplement studies 1 and 2 above, especially with respect to values in business districts and rentals.

4. Tax Effects

The effect of the BART property and sales taxes on property values and rents will be examined by reference to available studies of this subject and to relevant theory, but not by any new data collection or analysis.

5. Distributional Effects

The findings on property values and rents will be synthesized and interpreted to provide a generalized understanding of the effects of rapid transit on property values and rents, and to reveal the implications of these findings for the assessment of BART's distributional effects and for future decision making. The question of BART's effects on the level of total regional property values will be addressed by reference to the relevant body of theory, rather than by any attempt to measure region-wide impacts.

Research Questions to be Answered for all Activities above:
9,10.11.31,37

5.14 Study of Property Acquisition and Occupancy

PURPOSE

To determine the existence and extent of speculation around BART stations.

RESEARCH ACTIVITIES

Data on acquisition of property near BART stations, including speculative acquisition; on the usage of such property, including interim usage; and on occupancy patterns such as changes in amount of owner-occupancy will be examined by collection and analysis of secondary data on real estate activity around

selected stations, and by interviews of key informants in the real estate business in these areas.

The study areas will be located at the following stations:
El Cerrito Plaza, Rockridge, Walnut Creek, Fruitvale, Hayward,
24th & Mission, 19th Street, Powell Street.

Research Questions to be Answered: 12,30

5.15 Collection of Station Area Land Use Data

PURPOSE

To provide time series data for monitoring development and land uses in areas around BART stations.

RESEARCH ACTIVITIES

All buildings and parcels within 1,800 feet of BART station entrances will be covered by street-level and aerial photographs. A complete set of street-level (Photolog) photographs were taken in late 1974. Aerial photographs of BART station areas are available for 1965, 1972, and early 1975.

Corresponding to the photographic record, contemporary data on occupancy, assessed valuation, zoning, and other variables will be acquired and assembled. Data on selected variables have been assembled for all parcels covered by the 1974 street-level survey.

The data, street-level photographs and aerial photographs are cross-indexed at the block face level by means of transparent overlays which correspond to 1" = 200' scale maps produced from aerial photographs. The overlays denote block and parcel numbers, street addresses, and photolog frame numbers at street intersections.

Street-level photographs of BART station areas will be taken in mid-1976. A new set of data on the properties covered by the photos will be compiled at the same time. No new aerial photography will be taken at this time.

5.16 Policy-Oriented Case Studies

PURPOSE

To produce an in-depth, policy-oriented synthesis and interpretation of the impact data provided by the other Work Elements.

RESEARCH ACTIVITIES

Several areas, each falling predominantly within one municipality, will be selected for intensive study. The purposes of these case studies are to assure a comprehensive and balanced portrayal of all kinds of spatial impacts as they interact and as they affect specific communities and population groups, and to lay the foundation for answers to the all-important "how" question--how can local governments assure that BART's potential impacts on land use and urban development are guided and exploited by government so as to support and enhance the achievement of policy objectives?

All relevant data from the Land Use and Urban Development Project will be employed. Additional data on the study area will be acquired and incorporated as needed, as will information on the policies and problems of each municipality provided by the Public Policy Project, and information on problems of development in environmentally sensitive areas provided by the Environment Project.

The interpretation will identify the manner in which land use and urban development patterns resulting from BART and the private response to it hinder or assist the realization of municipal policies (including policies relating to harmonization of urban development with the environment), and will make suggestions on how transportation investments and land use controls can be employed to further the realization of municipal policies (with special reference to the prevention of adverse impacts on the environment resulting from land uses and development induced by transportation improvements).

Much of the information needed by these policy-oriented case studies will be provided by the more specialized case studies to be conducted in many of the other work elements, by the site-specific findings of the Environment Project, and by the case studies of the Public Policy Project. Localities for conduct of the policy-oriented case studies will be chosen at an early stage of the work of the Land Use and Urban Development and Public Policy Projects, after sufficient information has been obtained to assure the choice of areas that will produce the most useful information, but early enough to assure that these areas will be covered by the more specialized case studies that each project will be conducting.

The areas selected for policy-oriented case studies will include:

A central city area (in San Francisco or Oakland) containing some residential areas inhabited predominantly by minority groups and others inhabited predominantly by members of the majority, in which BART may provide an impetus to movement of both the majority and minority segments of the population.

An outlying older urban area (Richmond, San Leandro or Hayward) containing a central business district that might benefit from improved accessibility, and residential areas having a potential for renewal or conservation efforts.

A suburban area (Walnut Creek or Fremont and surrounding unincorporated areas) experiencing growth pressures and containing undeveloped land that is environmentally sensitive.

An area, of whatever character, in which especially significant governmental action has been taken to capitalize upon or guide BART impacts, or where significant conflicts between BART impacts and the desires of local citizens and officials have arisen.

Possibly one additional area, to be chosen on the basis of the opportunities for obtaining useful findings that are revealed as the research proceeds.

5.17 Recommendations for Long-Term Monitoring of BART Impacts

PURPOSE

To provide the Metropolitan Transportation Commission (MTC) and the Association of Bay Area Governments (ABAG), two regional agencies currently cooperating in a broad program of transportation and land use analysis, with specific recommendations for long-term monitoring of BART impacts.

Also in view of the long time span over which BART's locational impacts are likely to occur, all of the audiences of the BART Impact Program will continue to want information on this subject after the Program has terminated.

RESEARCH ACTIVITIES

Such monitoring can be conducted efficiently, with the aid of new data such as that to be provided by the 1980 census, if the data files and analytic procedures of this project are established and maintained with due regard for their continued use over the long term.

This Work Element will assure the establishment, preservation and documentation of files and procedures in a form that can be efficiently maintained and employed in the future as part of the regional analysis program. The Work Elements most suitable for long-term continuation, in modified form are 5.5 (Housing Industry), 5.8 (Office Activities), 5.9 (Retail Trade), 5.10 (Regional Simulation Model), and 5.15 (Station Area Land Use Data).

5.18 Preparation of Final Report

This Work Element will integrate the findings of all of the preceding Work Elements, producing a synthesis of the results obtained by complementary methods (such as interview surveys and secondary data) and the findings obtained on interdependent subjects (such as establishment locations, property taxes and property values). It will interpret the findings in order to provide policy-relevant guidance to decision makers in the Federal, State and local levels and to enhance the understanding of all who are interested in urban development processes.

Figure 4 below indicates how the various research issues discussed earlier in Section 3.3 will be studied in the Work Elements.

FIGURE 4

COVERAGE OF RESEARCH QUESTIONS IN WORK ELEMENTS

<u>WORK ELEMENTS</u>	<u>Research Questions</u>
5.1 Preparation of Study Design and Project Implementation Plan	
5.2 Accessibility Mapping	
5.3 Study of Households' Locational Decisions	
(1) BITS Study Areas	1. Dwelling location 13. Job location 17. Shopping location 20. Consumer services location
(2) Sunset, East Oakland Areas	1. Dwelling location 8. Outward movement of middle income 13. Job location
5.4 Study of Workers' Locational Decisions	1. Dwelling location 13. Job location 17. Shopping location 20. Consumer services location
5.5 Study of Housing Industry	
(1) BITS Study Areas	1. Dwelling location 2. Housing - new construction 3. Housing - redevelopment 6. Displacement of lower income people away from nuisance 27. Dwelling location 29. Housing location - away from nuisance 32. Housing location - expectations
(2) Pittsburg, Antioch	1. Dwelling location 2. Housing - new construction 3. Housing - redevelopment 32. Housing location - expectations

- (3) Sunset, East Oakland
- 5.6 Study of Office Contribution Industry
 - 23. Office building - new
 - 24. Office building - redevelopment
 - 25. Office development - intensity
 - 26. Lower income business displacement
 - 32. Housing location - expectations
- 5.7 Study of Development Patterns
 - (1) BART station areas
 - 3. Housing - redevelopment
 - 5. Residential development-stations
 - 6. Residential development - outlying areas
- 5.8 Study of Employers' Location-al Decisions
 - (1) Organizations needing access to labor force
 - 14. Employment location - accessibility force
 - 15. Employment location - near work force
 - (2) Firms needing access to other organizations
 - 22. Location near non-consumer services
 - (3) Other organizations
 - 28. Establishments - visual exposure
- 5.9 Study of Retail Sales and Consumer Services
 - (1) Shopping patterns
 - 17. Shopping locations
 - 20. Consumer services location
 - (2) Establishment location
 - 18. Retail outlets
 - 21. Other consumer service outlets
 - (3) Retail sales
 - 19. Retail Sales patterns
- 5.10 Study of Patterns of Spatial Distribution of Population, Housing and Employment
 - 4. Shift of population and housing
 - 16. Shift of employment

- | | | | |
|------|--|-----|--------------------------------------|
| 5.11 | Documentation of BART's Consumption of Land and Property | 33. | Displacement and demolition |
| | | 34. | Reuse and reoccupancy |
| 5.12 | Documentation of BART's Construction Impacts | 35. | Shopping relocation |
| | | 36. | Building maintenance |
| 5.13 | Study of Property Values and Rents | 9. | Increase near stations |
| | | 10. | Decrease between stations |
| | | 11. | Total regional increase |
| | | 31. | Decrease in BART district |
| | | 37. | Temporary decrease near construction |
| 5.14 | Study of Property Acquisition and Occupancy | 12. | Speculative acquisition |
| | | 30. | Speculative withholding |
| 5.15 | Collection of Station Area Land Use Data | | |
| 5.16 | Policy Oriented Case Studies | | |
| 5.17 | Recommendations for Long Term Monitoring of BART Impacts | | |
| 5.18 | Preparation of Final Report | | |

6. WORK PLAN

The following section provides general information on how the work described in the preceding sections should be performed in terms of schedule, staffing, and level of effort. A tentative schedule for accomplishing the research outlined in the Work Elements is provided. A general staffing plan is outlined. And based on the knowledge acquired in developing a research effort for each part of the project, MTC has made estimated of relative level of effort to be expended in the various Work Elements.

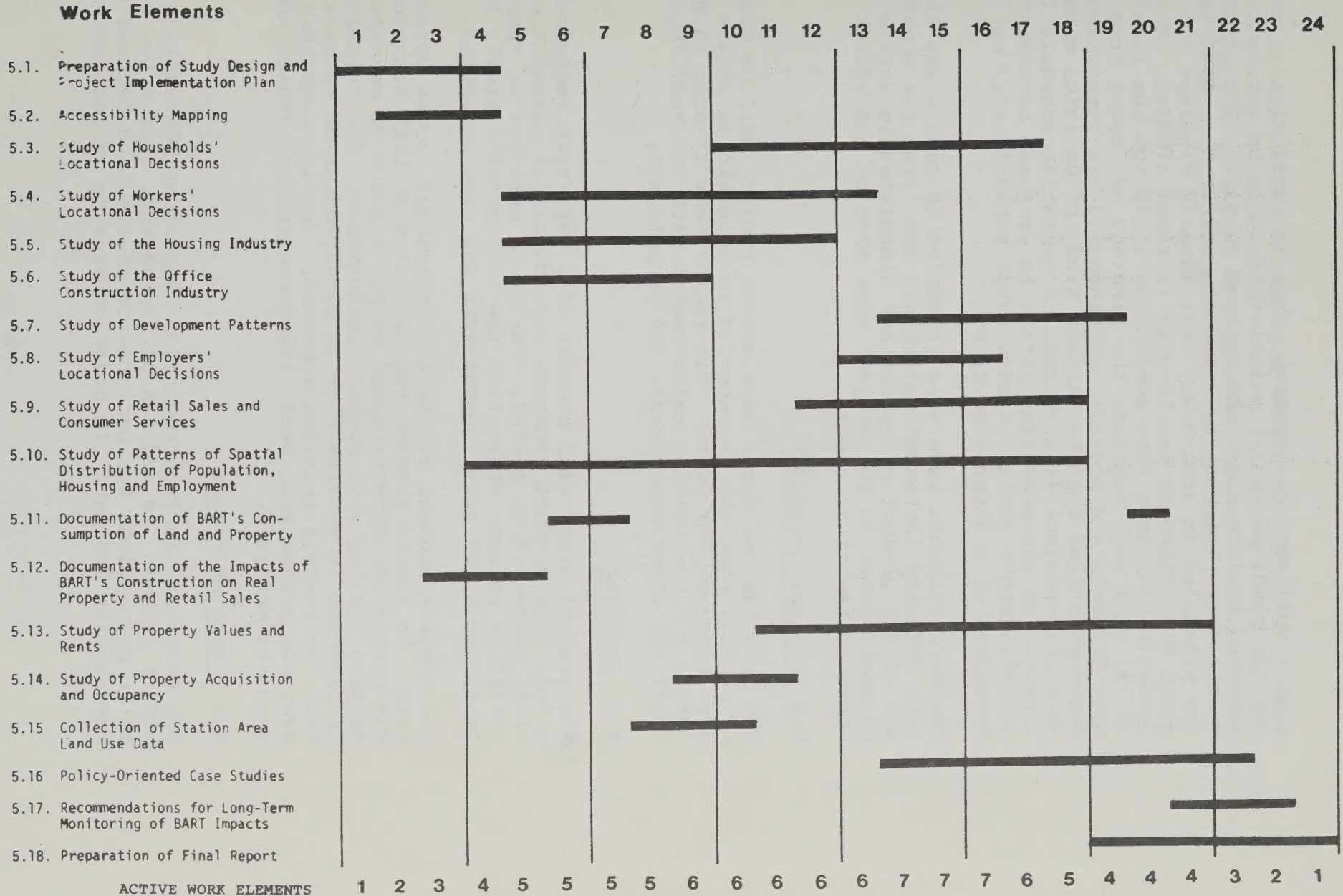
6.1 Schedule

The Land Use and Urban Development Project will have a 24-month duration. The starting date for the project is expected to be in January 1975. After completion of the project the Metropolitan Transportation Commission will continue to monitor impacts as needed. Figure 5 is a tentative schedule for project Work Elements.

Preparation of the Study Design and the Project Implementation Plan (5.1) will be the most important task among the three Work Elements initiated in the first three months of contract performance. Drafts of the final documents are expected early in the third month to allow sufficient time for MTC review and comment, and subsequent revision. Final approved documents must be submitted by the end of the fourth month. The study of workers' locational decisions (5.4) has been scheduled to dovetail with survey efforts being made by the Transportation System and Travel Behavior Project. The results of this Work Element should feed into the study of households' locational decisions (5.3) which has been scheduled to coordinate survey efforts with the Environment Project. The study of the housing industry (5.5) and the office construction industry (5.6), being somewhat parallel in scope and using similar key informant techniques, are scheduled to begin at the same time. Two relatively minor Work Elements, the documentation of BART's land consumption (5.11) and construction impacts (5.12), are scheduled early in the project to provide early findings and throw light on possible unanticipated impacts. The collection of station area data (5.15) is scheduled for the summer months when the angle of the sun is best for repeating the photographic survey. This schedule also provides sufficient lead time for processing of the data and use by other Work Elements. The study of property acquisition and occupancy (5.14) serves as a lead element for perhaps the most substantial of the Work Elements, the study of property values and rents (5.13). Both should be undertaken in a coordinated fashion. The study of retail sales (5.9) and employers' locations decisions (5.8) are scheduled at the project mid-point to permit study of

Figure 5

SCHEDULE OF WORK ELEMENTS



BART's full service impacts. This is particularly important for the study of retail sales which could be substantially impacted by late night and weekend service. The study of development patterns (5.7) and the policy case studies (5.16) are scheduled in such a way that interim findings from the other Work Elements can be used in these efforts. The recommendation for long term monitoring (5.7) and the final report (5.18) will pull together the findings of impact from other Work Elements and provide comprehensive interpretation and recommendations for the various kinds of decision makers to whom this project is directed. A tentative schedule for performance of the modelling effort is proposed between the fourth and eighteenth month. A more exact schedule will be developed at a later time by MTC.

The Work Elements have been scheduled in such a way that project activity increases moderately the first few months, levels off at the project mid-point and diminishes in active Work Elements later in the project when most of the effort is devoted to the final report.

6.2 Project Office

The Land Use and Urban Development Project will be conducted by a contractor who is expected to maintain an office in the San Francisco Bay Area. This requirement is made in order to assure a close working relationship with the BART Impact Program staff and other contractors and consultants.

6.3 Staffing

The project staff will consist of a part time technical director, a full time project manager, and additional research and technical personnel as needed. Part time services of specially qualified persons drawn from the contractor's staff, from subcontractors, or other consultants are also permitted.

The project manager is the key individual in the consultant team. He should provide the project with both technical and administrative direction and be MTC's point of contact for all matters dealing with project performance. The technical director is expected to provide high level direction in matters dealing with the overall research approach. Heavier commitments, of over one person year each, are expected from senior and junior research analysts.

6.4 Level of Effort

The Metropolitan Transportation Commission considers a level of effort between 100 and 120 person-months, over a two year period, to be appropriate for performance of the Land Use and Urban Development Project. In order to provide an indication of level

of effort among the various Work Elements, Figure 6 presents a tentative distribution of project resources. A final project budget will be based on more precise estimate resource requirements, staff skills, overhead and other costs.

Figure 6

APPROXIMATE LEVEL OF EFFORT

<u>WORK ELEMENT</u>	<u>Per cent Level of Effort</u>
1. Study Design and Project Implementation Plan	12
2. Accessibility Mapping	3
3. Households' Locational Decisions	10
4. Workers' Locational Decisions	3
5. Housing Industry	3
6. Office Construction Industry	3
7. Development Patterns	10
8. Employers' Locational Decisions	3
9. Retail Sales and Consumer Services	10
10. Spatial Distributions of Population, Housing and Employment	0
11. BART's Consumption of Land and Property	1
12. BART's Construction Impacts	1
13. Property Values and Rents	14
14. Property Acquisition and Occupancy	1
15. Station Area Land Use Data	1
16. Policy Oriented Case Studies	10
17. Long Term Monitoring of Impacts	1
18. Final Report	14

GENERAL REFERENCES

- I. The following references are for reports produced by the Institute of Urban and Regional Development (University of California, Berkeley). These reports, although preliminary methodological, contain some preliminary findings of BART's impacts on land use and retail sales before BART was in revenue service.

LAND USE AND INVESTMENT STUDY

Principal Investigator: Douglass B. Lee, Jr.

- | | |
|-------------|--|
| Volume I. | Econometric Studies
NTIS NO. PB 236 741/AS (\$5.25) |
| Volume II. | Key Informant Interviews
NTIS NO. PB 236 742/AS (\$4.75) |
| Volume III. | Case Studies
NTIS NO. PB 236 743/AS (\$4.75) |
| Volume IV. | Market Street Study
NTIS NO. PB 236 744/AS (\$4.75) |
| Volume V. | Pilot Land Use Information System:
Walnut Creek
NTIS NO. PB 236 745/AS (\$4.25) |
| Volume VI. | Impacts of BART on Prices of Single
Family Residences
NTIS NO. PB 236 746/AS (\$4.25) |
| APPENDIX | DATA DOCUMENTATION FOR THE LAND USE
AND INVESTMENT STUDY
NTIS NO. PB 236 750/AS (\$5.25) |

BART IMPACT ON RETAIL SALES

Principal Investigator: Louis P. Bucklin
NTIS NO. PB 236 747/AS (\$4.25)

II. LAND USE AND URBAN DEVELOPMENT PROJECT, PHASE I WORKING PAPERS

Boyce, David E., W. Bruce Allen, METHODS AND STRATEGIES FOR ASSESSING TRANSPORTATION IMPACTS ON LAND USE AND URBAN DEVELOPMENT.

Boyce, David E., W. Bruce Allen, RECOMMENDATIONS ON SPECIFIC RESEARCH PROBLEMS CONCERNING BART'S IMPACT ON LAND USE AND URBAN DEVELOPMENT.

Bucklin, Louis P., BART'S IMPACT ON RETAIL TRADE: A RESEARCH PROSPECTUS.

Bucklin, Louis P., RECOMMENDATIONS FOR BART RESEARCH ON RETAIL IMPACT.

Dornbusch, David M., BART-INDUCED CHANGES IN PROPERTY VALUES AND RENTS.

Goldner, William, LAND USE MODELS: HOUSING AND POPULATION ALLOCATION.

Lee, Douglass B. Jr., OVERVIEW OF METHODS AND STRATEGIES FOR ASSESSMENT OF TRANSPORTATION IMPACTS ON LAND USE AND URBAN DEVELOPMENT.

Lee, Douglass B. Jr., EXTENSION AND FUTURE APPLICATION OF PRE-BART LAND USE DATA COLLECTION AND METHODOLOGY.

McGuire, Chester C., CULTURAL AND ETHNIC MINORITY IMPACTS OF BART-INDUCED LAND USE CHANGE.

Patri, Tito, Thomas Ingmire, REGIONAL OPEN SPACE RESOURCES AND THE IMPACTS OF BART INDUCED LAND USE CHANGES.

Putman, Stephen H., A DISCUSSION OF PROCEDURES FOR ASSESSING THE IMPACTS OF THE BART SYSTEM ON THE SPATIAL DISTRIBUTION OF EMPLOYMENT IN THE SAN FRANCISCO BAY AREA.

Skaburskis, Andrejs, SURVEY OF DATA SOURCES FOR THE LAND USE AND URBAN DEVELOPMENT PROJECT.

Wheaton, William C., MODELING THE REGIONAL LAND USE IMPACTS OF BART.

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